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**Preserving
Our
Lifeline:**

Solutions for Management of Urban Stormwater in the Bow River Basin

Report of the



September 1999



Solutions for Management of Urban Stormwater in the Bow River Basin

The cover photograph shows new residential development in the McKenzie Towne community in Southeast Calgary. Runoff from the development drains into the storm pond shown in the foreground, from which controlled discharges are made to the Bow River (background) via storm sewer. (Courtesy: Stantec Consulting Ltd.)

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Solutions for Management of Urban Stormwater in the Bow River Basin



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Thank you to the members of the Bow River Basin Water Council who contributed to the preparations for the workshop; to Pat Kinnear, the Business Manager for the Council; and to the individuals who volunteered to work as facilitators and recorders.

Thank you also to Kim Lalonde, Kim Lalonde Environmental Consulting, who facilitated the workshop and wrote the final report, with assistance from Pat Kinnear, Rob Wolfe and Jacqueline Mann.

Foreword

In the summer of 1998, the Bow River Basin Water Council made a commitment to hold a workshop to discuss the management of urban stormwater in the basin and how this management could be improved. The Council formed a partnership with the Canadian Water Resources Association. This partnership resulted in a conference *Municipal Stormwater Management: Issues and Challenges* and workshop *Solutions for Municipalities in the Bow River Basin*, held on April 29 and 30, 1999.

The results of the workshop discussions have been summarized in this report. There was general agreement among all the workshop participants that stormwater is a concern and that urban stormwater should be considered within the broader context of watershed management.

This report is being submitted to the Minister of Environment and to all local government jurisdictions in the basin. The commitment of the Bow River Basin Water Council to address urban stormwater management is reflected in the recommendations and action plan found in this report. All jurisdictions and stakeholders in the basin are being asked to join in this commitment and to work in a cooperative way to manage and protect the water resources of the basin for the benefit of all.

M.T. Homan, P.Eng., MBA
Chair, Bow River Basin Water Council

THE BOW RIVER BASIN WATER COUNCIL'S MANDATE

For the purposes of protecting and improving the waters of the Bow River Basin and with respect to any social, cultural, economic and environmental aspects of:

- *the quality and quantity of groundwater and surface water*
- *riparian zones*
- *the effects of human activity and land use on surface and groundwater quality and quantity*

in the Bow River Basin, the Bow River Basin Water Council will:

- *maintain a forum for all stakeholders to share perspectives*
- *participate in water use management and basin planning*
- *prioritize stakeholder water issues, develop action plans, and organize and encourage implementation of cooperative water use management strategies*
- *monitor, evaluate and report on programs to the Minister, stakeholders and the public*
- *recommend improved water use management procedures and performance measures.*



Distribution

This report will be submitted to the following local governments:

The Municipal District of Rocky View
The Municipal District of Foothills
The Municipal District of Bighorn
The Municipal District of Willow Creek
The Municipal District of Taber
The Municipal District of Ranchlands

The County of Wheatland
The County of Vulcan
The County of Newell
Cypress County

The City of Calgary
The City of Airdrie
The City of Medicine Hat

The Town of Banff
The Town of Bassano
The Town of Brooks
The Town of Black Diamond
The Town of Canmore
The Town of Cochrane
The Town of Chestermere
The Town of Gleichen
The Town of High River

The Town of Nanton
The Town of Okotoks
The Town of Strathmore
The Town of Turner Valley
The Town of Vauxhall
The Town of Vulcan

The Village of Arrowwood
The Village of Carmangay
The Village of Cayley
The Village of Duchess
The Village of Hussar
The Village of Longview
The Village of Milo
The Village of Rockyford
The Village of Rosemary
The Village of Standard
The Village of Tilley

Improvement District No. 5
Improvement District No. 9

T'suu T'ina Nation
Siksika Nation
Stoney Nation

Copies will also be provided to all workshop participants.

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1.0 Introduction

In July of 1998, the Bow River Basin Water Council published a *Survey of Urban Water Use in the Bow River Basin*. This report was a follow-up to the Council's first report on the overall state of the Bow River ecosystem, *Preserving our Lifeline: A Report on the State of the Bow River, Calgary, Alberta, July 1994*. "This first report showed that while we have made significant strides in addressing a wide variety of Bow River use issues, major challenges to river use management are still before us. One of the key challenges is continuous improvement in the management of urban sewage and stormwater (runoff from urban streets and land)." *Survey of Urban Water Use in the Bow River Basin, July, 1998, p. iv*

The *Survey of Urban Water Use in the Bow River Basin* summarizes information provided by 26 municipalities within the basin on how they manage their land use, water supply and consumption, sewage and stormwater. It includes recommendations intended to provide guidance to the municipalities, their residents and the provincial government, who, acting together, can improve urban water use management and reduce the impact of urban sewage and stormwater on the Bow River system. One of these recommendations was that:

11. A workshop of municipalities and the provincial government should be held to discuss how municipalities currently manage water quality and how this can be improved, municipal concerns and how the Bow River Basin Water Council can assist.

The Bow River Basin Water Council initiated a partnership with the Alberta Branch of the Canadian Water Resources Association to organize a conference and workshop on improving urban stormwater management in the Bow River Basin. The conference and workshop were held in Calgary on April 29th and 30th, 1999, with participants from the provincial government, local governments in the basin, First Nations, the development industry, the consulting industry, non-profit organizations and the general public. On the first day of the two day event, a wide range of speakers provided information on urban stormwater management. On the second day, participants worked in small discussion groups. The objectives of the workshop were as follows:

WORKSHOP OBJECTIVES

1. To provide a forum to discuss how municipalities and developers currently manage stormwater (and in particular stormwater quality) and how this can be improved, to discuss municipal concerns, and to discuss how the Bow River Basin Water Council can assist.
2. To ensure that members of the Bow River Basin Water Council and other interested parties have an opportunity to participate in the discussions and to express and share perspectives and ideas.
3. To provide information for the Bow River Basin Water Council to support the preparation of a report on how stormwater management can be improved in the basin, including recommendations to the Minister of Environment, to be submitted to the Minister and to all jurisdictions in the basin.

2.0 A Summary of the Workshop Discussions

During the workshop session, approximately 105 participants broke into 8 working groups. Prior to the workshop, participants were provided with a *Proposal for a Watershed Approach for Urban Stormwater Management in the Bow River Basin*. The proposal was intended to stimulate discussions on the proposed objectives and key elements of incorporating urban stormwater management into a watershed planning approach.

Participants were asked to comment on their overall reaction to a proposed watershed approach to managing urban stormwater, a proposed regulatory framework, a proposed planning and development framework, the application of best management practices, and the need for monitoring and suggested roles and responsibilities. A copy of the *Proposal* is found in Appendix 1.

Each group had a Chair from the Bow River Basin Water Council, a facilitator and a recorder. All of the discussions were recorded on flipcharts. In addition, participants were given sheets to provide their individual comments. The following is a summary of the group discussions and the comment sheets. It is intended to highlight key points and common areas of discussion. Full transcripts of the flipcharts and transcripts of the comment sheets are available from the Bow River Basin Water Council, upon request.

IS URBAN STORMWATER MANAGEMENT AN ISSUE?

The speakers at the conference on the first day provided valuable information regarding the impacts of urban stormwater discharges on the water quality of receiving waters. While it was recognized that more monitoring and analysis is needed in the Bow River Basin, existing data confirm that effects on water quality are a concern. Participants at the conference were also advised that there is overwhelming evidence from other jurisdictions in North America and around the world of impacts of stormwater on water quality.

Participants at the workshop session agreed that urban stormwater management is an issue. Their discussions focused on how it can be improved.

URBAN STORMWATER MANAGEMENT AS PART OF A WATERSHED PLANNING APPROACH

There was general support for the concept of incorporating the management of urban stormwater into a watershed planning approach. Participants saw this as an integrated approach where all parties must be involved and work together. There was also a recognition that taking a watershed approach means that all elements of the watershed must be considered. Participants believed that urban stormwater cannot not be considered in isolation. Contamination from other sources including rural and agricultural runoff and industry sources must also be addressed.

Participants identified that there appeared to be consensus about the need to include urban stormwater management in a watershed approach and that the challenge would be in implementation. Most groups felt that more detail is required about how this would be done in the Bow River basin, with clear roles and responsibilities and clear rules and requirements for stormwater management. One group suggested that the approach to urban stormwater management in the basin should be documented in a way that could be understood by all parties involved and by the general public. Another group suggested the establishment of a steering committee to address roles and responsibilities, process, a timeline and targets.

A number of groups discussed the importance of evaluation and feedback. They identified a need for flexibility for improving systems and best management practices as feedback and more information about

urban stormwater management become available. This reflected the importance of good scientific information to support planning, decision making and implementation. One group noted that “testing” is needed to find out economic realities as well as other implications. It was felt that a flexible approach is essential to encourage innovation.

There were a number of comments about the need to take action while continuing to work to improve urban stormwater management, continue research and increase public awareness.

Some groups suggested the establishment of a pilot project or projects to demonstrate how a watershed approach can be taken, how interjurisdictional issues can be addressed, and to look at areas located outside of the City of Calgary.

REGULATORY FRAMEWORK

A key concern raised by participants was a need for clarification of the regulatory requirements. There was some confusion over what the regulatory requirements are, ongoing changes in requirements, and the responsibilities of the provincial government and local governments. This was coupled with comments about the need to streamline approval processes, keep them as simple as possible, and apply them in a fair and equitable way. There were some comments about the need for a one-window approach for approvals. Another area of concern was the application of any new rules or stormwater management approaches to existing facilities and how such transitions should be handled.

A key area of discussion focused on the need for guidelines for urban stormwater management versus the need for regulations or standards. There was some support for clear rules, with the province setting minimum standards. Some felt that in the absence of standards, there is no incentive to undertake water quality enhancements.

Other groups discussed the need for guidelines. These would provide flexibility to address differing conditions and issues throughout the basin. They would also provide the flexibility necessary to support the development and operation of best management practices. It was noted that the Municipal District of Rocky View started with site specific regulations and is now moving to general regulations. Related to this discussion were comments made about the difficulty in defining what is acceptable, in establishing numbers for a regulatory approach, and in regulating non-point sources.

Whatever the view held, there was agreement that there needs to be clarification about the definitions of regulations, standards, performance standards and guidelines, and clarification about the regulatory approach in the basin.

PLANNING AND DEVELOPMENT FRAMEWORK

Participants identified the need to plan cooperatively, with all parties involved. One group noted that all stakeholders share in the planning, and so share in the long term success or failure to manage urban stormwater effectively. Groups noted that the planning framework needs to be understandable by the public. Other needs that have to be addressed include a cooperative mechanism for sub-watershed planning, accountability, timelines, and sharing of information. The Fish Creek watershed study was noted as an example of how jurisdictions can cooperate.

ROLES AND RESPONSIBILITIES

All groups discussed roles and responsibilities of the various parties in the basin. Generally, there were comments that these must be clearly defined. One group suggested that “accountability” should be used instead of “responsibility”.

Role of Alberta Environment

There were a number of areas of responsibility identified for Alberta Environment. There were comments that Alberta Environment needs to lead watershed management planning and to set objectives for local planning. Generally, there were comments that Alberta Environment needs to set the rules for urban stormwater management, but must consult with all stakeholders in setting them. Alberta Environment needs to support municipalities, providing mentoring and direction, and municipalities need to plan at the local level to meet the rules that are set.

There was also discussion that Alberta Environment shares responsibility for ongoing delivery of urban stormwater management and that Alberta Environment should be responsible for compliance and enforcement.

Finally, comments were made that Alberta Environment should coordinate information exchange.

Role of Local Governments

There was discussion about the need for municipalities to participate fully in management planning, with leadership by the province. As noted above, comments were made that municipalities need to plan at the local level to meet the rules set by Alberta Environment.

Also identified was the responsibility to ensure that action on urban stormwater management is taken and that local cooperation is harnessed. One group suggested creating local bodies for areas of mutual interest.

There were specific concerns raised about the lack of legislation at the municipal level to enforce urban stormwater management requirements for the development industry. A suggestion was made that local by-laws dealing with prevention of contamination should be required by Alberta Environment.

Role of the City of Calgary

There were suggestions made that the City of Calgary needs a coordinated approach between divisions to address urban stormwater in an integrated way. There were also comments made that the City has a lot to share and could do more mentoring with surrounding communities on water quality management in general, and urban stormwater management in particular.

Role of Developers

There were a number of comments about developers. Developers need to be involved in planning on a watershed scale and in detailed planning for sites and facilities. One group felt that they should be taking action on "best demonstrated technology", with municipalities. This was supported by another comment that developers must take responsibility as urban stormwater management is at a critical stage. It was noted, however, that developers cannot take all the risk for innovation – this must be shared. One group thought that developers should participate in monitoring.

Role of Other Stakeholders

While there was discussion about the need to involve stakeholders, about the need for individuals to take responsibility, and for all parties to play a role in increasing public awareness and education, the groups did not discuss more specific roles for other stakeholders.

Role of the Bow River Basin Water Council

A number of roles were identified for the Council. A key one was public education and stakeholder education. The Council should work to keep the issue of urban stormwater management in the forefront.

The Council was also seen as a facilitator to look at the “big picture” and bring parties together. The Council should define the scope of a watershed approach and work to get all stakeholders involved. One group noted that the Council’s role is advisory in nature and it cannot make the rules. The Council was also seen as a body that could act as a forum to mediate water use conflicts and complaints.

One group made a suggestion that the Council could be an independent third party in a “pollution source credit” system. Based on models in the United States, the Council could act as an administrator of a watershed-based pollution trading regime.

General

Comments were made about the transfer of responsibility for urban stormwater management systems and facilities over time. Related to this were comments about responsibility over the long term for maintenance and retrofitting needs.

BEST MANAGEMENT PRACTICES

A number of comments were made about the use of best management practices (BMP’s). Generally, there was support for the development and monitoring of BMP’s. There was some concern expressed that it is difficult to implement innovative ideas or approaches and there needs to be more support for innovation. Related to this were questions about long term maintenance requirements and the risk of failure of BMP’s.

Another area of discussion was the need to develop strategies to identify the sources of urban stormwater contamination, especially non-point sources, and the need to monitor and control non-point sources. There was also discussion about the need to look at controlling pollutants at the source instead of focusing on “end of pipe” solutions only.

MONITORING

Half of the groups discussed issues related to monitoring. One group talked about the importance of monitoring to help with identifying real impacts versus perceived impacts of urban stormwater discharges.

There were comments made about the need for good baseline information. There was discussion about the use of both biological monitoring techniques and chemical monitoring techniques, the need for a variety of “measurables”, the need to monitor both surface water and groundwater, and the need for consistency in monitoring. Concerns were raised about a lack of access to information and problems with sharing of information.

Responsibility for Monitoring

One group felt that the province should set the regulatory monitoring requirements. The framework for monitoring would be set by the City of Calgary and developers would implement it. Another group felt that Alberta Environment should act in an advisory role for developing a monitoring system. Stakeholders who would be interested in contributing to the total area monitoring system would be identified and the system would operate on a cooperative basis. A third group identified the need for interagency cooperation on monitoring.

COSTS AND FUNDING

Almost every group discussed issues related to costs and funding. It was recognized that there are limited resources available. The discussions included some expressions of concern about the level of funding for Alberta Environment and for the City of Calgary, and the level of funding for urban stormwater management in general.

A number of groups talked about the need to put limited financial resources to their best use. There were comments about the need to take action now, as costs will be higher later, especially if retrofitting is needed. Municipalities have a concern about the extent of retrofitting for existing development that may be required and the costs. There was discussion about the need for joint partnerships and exploring creative funding and targeting opportunities.

A key area of discussion was the issue of who should pay for the costs of urban stormwater management. The concept of user-pay was raised, with the issue of user-pay as it relates to point versus non-point sources identified. There was discussion about the application of a general tax versus a user-pay directed tax or levy. This was related to discussions about capital costs versus maintenance costs and who pays for them, stormwater management in existing developments versus new developments and who pays the costs; local facilities versus regional facilities, and costs of monitoring.

There was some discussion of the idea of considering urban stormwater management as a utility. A number of other economic tools were raised including a hard surface surtax, a surtax on the cost of products such as fertilizers and pesticides, an impact tax based on the impact created, a special tax for existing areas that do not have adequate stormwater management facilities, and a system of "utility credits" for new developments that have stormwater management facilities. This included comments on the need to develop incentives and disincentives.

There was discussion about the possibility of reducing municipal reserves to allow some land to be set aside for stormwater management facilities. Included in this were discussions about long term maintenance requirements and who would be responsible. Environmental reserves were also mentioned in this context.

AWARENESS AND EDUCATION

Almost every group discussed this topic and there was a strong consensus on the importance of increased awareness and education - for the general public, young people, municipalities, elected officials, staff, regulators, engineers, developers and the Bow River Basin Water Council. One group felt that all parties should take responsibility for education. As noted above, a key role identified for the Bow River Basin Water Council was public education and stakeholder education. Another group noted that municipalities need help to undertake education programs.

It was recognized that urban stormwater management is not an issue at the top of people's minds. There is a need to increase awareness and to change attitudes about water. The public needs to have a better understanding of the value of the resource and the costs related to maintaining the high quality of water that we all enjoy. It was felt that if there is a better understanding and a personal commitment, individuals will be more willing to deal with costs.

One group suggested that there be a focus on implementing an education plan about the watershed approach while work progresses on defining technical aspects of the approach. Another group talked about the value of more field based education. Stormwater management facilities should be more visible and available for inspection by the public.

A suggestion was made that the education process should not overlook achievements already made. Related to this comment, the development industry expressed a need to get information out regarding improvements that the industry has made, without regulation.

3.0 Recognizing Achievements and Charting a Course Ahead

RECOMMENDATIONS AND AN ACTION PLAN

The Bow River Basin Water Council took the information, discussions and advice from the conference and workshop and developed the following recommendations and action plan. The Council worked to develop these recommendations and actions in the context of both the issues and the initiatives already completed or underway in the basin. These achievements should be recognized and used as a foundation to take further action to improve the management of urban stormwater.

Under each recommendation, there are two types of actions identified. The first actions are commitments made by the Bow River Basin Water Council. The Council will establish an Urban Stormwater Management Project Team by January 2000, to ensure that these commitments are met and to report on progress to the Council. The second actions are recommendations made by the Council to appropriate parties in the basin. Most of these parties are current members of the Council and participated in the development of this report. The Council will provide ongoing support and encouragement for those actions. Time frames have been identified for the actions. Short term is generally intended to mean up to one year and medium term is one to two years. Ongoing commitments have also been identified.

RURAL RUNOFF AND STORMWATER MANAGEMENT

The conference and workshop, and the recommendations and action plan flowing from them, focussed on urban stormwater management. Workshop participants and the Bow River Basin Water Council recognized that rural runoff and stormwater must also be addressed within the context of a watershed approach. The Council will move ahead with its standing commitment to consider the impacts of rural runoff and how management of rural runoff can be improved in the basin.

3.1 URBAN STORMWATER MANAGEMENT AS PART OF A WATERSHED PLANNING APPROACH

ACHIEVEMENTS

Bow Basin Plan

This river basin plan is currently underway and is scheduled to be completed in June 2001. It will result in an information base, analytical tools, and recommendations to support environmental management decisions in the Bow River Basin.

Nose Creek Watershed Water Quality Management

The City of Airdrie, the City of Calgary and the Municipal District of Rocky View have made a commitment to taking a cooperative approach in addressing water quality issues in the Nose Creek watershed. The partnership is striving to implement appropriate best management practices for stormwater management.

Fish Creek Storm Drainage Study

In response to concerns regarding the water quality and quantity of stormwater discharges into Fish Creek, Alberta Environment and the City of Calgary have jointly agreed to conduct a storm drainage study of an area draining to the creek. As well, a biophysical impact assessment of the study area is underway to assess the impacts of stormwater and stormwater facilities.

Shepard Stormwater Management Plan

In 1992, Alberta Environment initiated the Chestermere Lake Consultation Process to address the impact of urban stormwater on Chestermere Lake and the Western Irrigation District. Subsequent engineering studies eventually led to the proposal for the Shepard Stormwater Diversion Project. This partnership project between the City of Calgary and Alberta Environment would provide a regional stormwater drainage solution and address both the quantity and quality aspects of stormwater.

Priddis-Pine Creek Drainage Study

In 1992, as part of the long range planning process, the City of Calgary completed a hydrological study of the Pine Creek Watershed. The study evaluated impacts of the projected 60-year urban development scenario on the flood hydrology of Pine Creek and recommended an appropriate level of control to reduce the impacts of the increased urban stormwater runoff.

Town of Okotoks Sustainable Community Initiative

The Town of Okotoks has a vision to be a sustainable community. In order to achieve this vision, the Town has made commitments related to all aspects of community decision making and growth. These commitments include limiting growth of the Town based on the environmental carrying capacity, employing watershed management agreements where possible, utilizing local resources efficiently and fostering activities that use materials in continuous cycles.

RECOMMENDATION

All parties in the basin should endorse integrating urban stormwater management into a watershed planning approach. All parties should clarify their roles and responsibilities, and make a commitment to effectively implement this approach.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Develop a clear and concise document on how urban stormwater should be managed in the basin, including the roles and responsibilities of all the parties in the basin.
2. Ensure that urban stormwater management is included as a component of the Bow River Basin Water Management Plan, at an appropriate scale.
3. Consider urban stormwater management when priorities for sub-basin watershed planning are being established.
4. Facilitate the establishment of a pilot project on urban stormwater management to be used for demonstration purposes.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓		
✓		
		✓
	✓	

The Bow River Basin Water Council **recommends** that:

1. All members of the Council endorse the document on urban stormwater management in the basin.
2. Local governments address urban stormwater management as part of sub-basin watershed planning, in cooperation with neighbouring or affected jurisdictions.
3. Alberta Environment continue to work with local governments to identify a reasonable approach that can be used when a full sub-watershed plan is not in place and decisions must be made.

TIMEFRAME

Short Term	Medium Term	Ongoing
	✓	
✓	✓	✓
✓	✓	

3.2 A FIRM AND CLEAR REGULATORY FRAMEWORK

ACHIEVEMENTS

Publication of the Stormwater Management Guidelines for the Province of Alberta, January 1999 by Alberta Environment

These guidelines are intended to help municipalities, local authorities, consulting engineers and developers in the planning and design of stormwater management systems in Alberta. They outline the objectives of stormwater management and the available methodologies and concepts for the planning, design, and operation of stormwater management drainage systems.

Development of a Total Loading Limit Program for the City of Calgary

The City of Calgary's current approval under the *Environmental Protection and Enhancement Act* to operate a wastewater and storm drainage system is in effect from January 1996 to November 2005. Under this approval, the City is required to plan, design, construct and manage the operation of the wastewater and storm drainage system to comply with limits for carbonaceous biochemical oxygen demand, total suspended solids, total phosphorus and ammonia-nitrogen discharged to receiving waters. Total loading limits for the combined stormwater and wastewater discharges will be established on or before January 1, 2003.

The City of Calgary's "Drainage By-Law"

In 1998, the Council of the City of Calgary approved a comprehensive bylaw (number 26M98) which regulates the quantity and quality of stormwater discharges within the City. The bylaw includes provisions which allow for fines or imprisonment, or both, if the bylaw is contravened.

RECOMMENDATION

Alberta Environment should provide clear direction on the regulatory requirements for urban stormwater management in the basin, in cooperation with local governments. The roles and responsibilities of regulators and of other parties should be clarified.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Work with Alberta Environment and other organizations, such as the Canadian Water Resources Association, to organize information sessions on regulatory requirements for urban stormwater management.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	✓

The Bow River Basin Water Council **recommends that:**

1. Alberta Environment and local governments provide clear and concise information on the regulatory requirements for urban stormwater management in the basin, in formats appropriate for stakeholders and the general public.
2. All members of the Council endorse the development of a Total Loading Limit Program for the City of Calgary.
3. Alberta Environment and the City of Calgary provide information to other parties in the basin on the implementation of the Total Loading Limit Program.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	✓
	✓	✓

3.3 USING BEST MANAGEMENT PRACTICES

ACHIEVEMENTS

Dry Ponds, Wet Ponds and Constructed Wetlands

The purpose of a dry pond is to temporarily store runoff in order to promote the settlement of pollutants and to restrict flows to reduce downstream flooding and erosion potential. Dry ponds are designed to empty completely between storm events. Wet ponds are permanent water bodies designed to control downstream flows and to allow for the diversion and settling of stormwater.

A constructed wetland is an artificial re-creation of a natural wetland where the land is depressed, water accumulates and aquatic plants and animals live. The stormwater is retained in the wetlands long enough for sediments to settle out and nutrient levels to be reduced.

There are 49 dry ponds, 31 wet ponds and 8 constructed wetlands which have been developed for stormwater management purposes in the City of Calgary.

Source Control Best Management Practices

The following are some examples of best management practices used in the basin which are intended to control contamination at the source.

Erosion and Sedimentation Control Guidelines

Erosion and sedimentation control guidelines are intended to prevent large amounts of sediment-laden water from running off a site during construction. In 1992, the City developed such guidelines for the development of new subdivisions and construction projects. The Town of Cochrane has also adopted these guidelines.

Street Sweeping Programs

The City of Calgary's annual spring cleanup involves 25 street sweeper vehicles which pick up approximately 50,000 tons of gravel and dust off of Calgary's streets.

Chemical Round-ups and Paint Exchange Programs

Chemical Round-ups and Paint Exchange Programs provide opportunities for the public to dispose of hazardous household chemicals and paints in a safe manner. The Calgary Fire Department accepts hazardous household chemicals and paints at four stations located throughout the city for safe disposal.

City of Calgary Hazardous Spills and Emergency Response Programs

Two programs have been developed to respond to emergencies within the City of Calgary. The Managing Dangerous Spills Program includes detailed procedures for spill assessment and clean-up, and for notification of necessary parties. The Localized Emergency Response Program manages the response, notification and reporting of any events that could threaten life or cause substantial property damage within the City.

Quantification of Non-point Source Pollution

The University of Calgary Environmental Science 502 class of 1999 completed a preliminary assessment of the quantification of non-point source pollution into the Bow River within the City of Calgary limits and investigated possible management alternatives. The assessment explored the issues of stormwater, wastewater, groundwater, atmospheric deposition, pollution trading and biomonitoring.



RECOMMENDATION

All parties in the basin should support the development, use, monitoring, evaluation and improvement of best management practices, with consideration of local conditions and needs.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Facilitate sharing of information among jurisdictions on successes and concerns with the use of best management practices.
2. Work with all parties in the basin to identify point and non-point sources of urban stormwater runoff and possible ways to better control sources of contamination.

TIMEFRAME

Short Term	Medium Term	Long Term
✓	✓	✓
✓	✓	✓

The Bow River Basin Water Council **recommends** that:

1. Local governments use, monitor and evaluate best management practices, as appropriate.
2. Consultants, developers and the academic community continue to develop and support the use of best management practices, as appropriate.
3. Local governments put in place regulatory mechanisms and other incentives to address contamination of urban stormwater.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	
	✓	✓

ACHIEVEMENTS

Rainfall Analysis

The University of Calgary Weather Research Centre completed an intensity duration frequency analysis in 1998 for storm events in Calgary. Characterization of storm events is an important process in the evaluation of urban stormwater impacts.

Elbow Valley Development, Municipal District of Rocky View

The Elbow Valley residential development is located southwest of the City of Calgary in the Municipal District of Rocky View. The development philosophy for Elbow Valley is based on ecosystem approaches and harmonizing natural habitats with a residential community.

The development features two man-made lakes. Self imposed water quality guidelines have been developed to ensure the health of the aquatic lake systems as well as allowing for recreational water activities. Similar water quality management strategies are implemented to deal with surface runoff to safeguard releases from the development area ultimately entering the Glenmore Reservoir, a drinking water reservoir for the City of Calgary. This has been achieved by best management practices including existing and constructed wetlands, lot specific stormwater management plans and numerous vegetated swales. A watershed development strategy document for the project describes the stormwater philosophy for the entire development area. This document is referred to when designing the stormwater management system for individual phases. More detailed stormwater management plans are developed when individual homes on acreages or a cluster of homes are planned for construction.

Bridlewood Development

The Bridlewood Subdivision in Southwest Calgary incorporates a large existing wetland, approximately eight hectares in size. The original wetland, created some twenty to thirty years ago by an access road, now serves as a multi-purpose facility for residents in the subdivision while providing habitat for wildlife.

The wetland's primary function, to temporarily detain stormwater quantity, ensures that the single most important aspect of sustaining a very healthy wetland is safeguarded. Pre-development flows are mimicked as much as possible. This has been achieved by limiting the actual catchment area that is being serviced by the wetland and providing for flow through of water released from upstream storage facilities.

The wetland biological processes and complex hydrologic routing provide for a process to improve the water quality entering the system from the upstream urban areas. A large forebay has been proven to be very successful in removing larger sediment particles; a most important management aspect considering that the subdivision will be under construction for a few more years to come. An extensive water quality monitoring program continues to support the developer and his consultant with detailed data to adjust any management system component, should this be necessary.

An important aspect of this development is the commitment that was made to educational efforts. This included "awareness" campaigns at the sales centres, information packages for distribution among house buyers, and a Bridlewood Wetland web page. Residents are aware of the environmental sensitivity of the wetland and their role in protecting it.

RECOMMENDATION

All parties in the basin should support research and encourage innovation related to urban stormwater management.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Facilitate the efforts of member organizations to identify and prioritize research needs and to identify research capabilities related to stormwater management.
2. Support member organizations in obtaining funds and/ or facilitating research into stormwater management issues in the Bow River Basin.

TIMEFRAME		
Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	✓

The Bow River Basin Water Council **recommends** that:

1. Governments, developers, consultants and the academic community encourage innovation in urban stormwater management through positive incentive programs.
2. Alberta Environment review the available research literature relating to the accumulation of contaminants in wetlands and the potential for impacts on wildlife.

TIMEFRAME		
Short Term	Medium Term	Ongoing
✓	✓	✓
	✓	

3.5 MONITORING

ACHIEVEMENTS

City of Calgary Urban Runoff Quality Monitoring

Since 1992, the City of Calgary, through the Sewer Division of the Engineering and Environmental Services Department, has undertaken an extensive urban runoff quality research and monitoring program. The City is currently monitoring six storm sewer outfalls in an effort to collect representative stormwater quality data for quantifying the total pollutant loading contribution to the receiving stream. The goal is to prepare computer models for predicting the effects of urban runoff on receiving waters. In addition, several stormwater ponds and constructed wetlands are being monitored to determine their effectiveness in removing contaminants from stormwater.

Alberta Environment Studies on Effects of Urban Stormwater Discharges on Receiving Waters

The Water Management Division of Alberta Environment sampled the Bow River during summer storm events in 1994 and 1995, to measure total loading and assess the impact of urban runoff on river water quality. In 1995, a network of automated samplers was used to collect samples every two hours throughout a storm at five sites from Bearspaw to the downstream city limit of Calgary, and at two sites further downstream. Alberta Environment has conducted similar automated sampling to measure the impact of urban runoff to the Western Irrigation District Headworks Canal, which drains into Chestermere Lake. Alberta Environment has also conducted basin-wide surveys and maintains an extensive network of long-term river monitoring sites on the Bow River that can be used to assess the relative importance of loading from urban runoff in Calgary, and monitor trends in water quality.



RECOMMENDATION

The needs for monitoring to determine impacts of urban stormwater on surface water and groundwater quality should be defined, within the context of the overall water quality monitoring framework in the basin. Roles and responsibilities for this monitoring should be clarified.

The needs for performance monitoring of urban stormwater systems should be defined, and roles and responsibilities clarified.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Work with Alberta Environment and all other parties to define monitoring needs related to urban stormwater management.
2. Work with jurisdictions in the basin to ensure that clear and equitable roles and responsibilities for monitoring are identified.
3. Facilitate information exchange from monitoring efforts of all parties in the basin.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	
	✓	
✓	✓	✓

The Bow River Basin Water Council **recommends** that:

1. All members of the Council be accountable for their roles and responsibilities for monitoring.
2. All members of the Council share information from monitoring efforts and share monitoring resources, where possible.
3. Alberta Environment act as a coordinator of monitoring data, supporting data integration, storage and dissemination through a provincial data management system.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	✓
	✓	✓

3.6 AWARENESS AND EDUCATION

ACHIEVEMENTS

Elbow Valley Constructed Wetland

The City of Calgary established a Wetland Task Force in 1994 to study the feasibility of incorporating constructed wetlands into the existing stormwater management program. The result was the construction of the 69th Street wetland in 1995 in an effort to evaluate the effectiveness of this technology under the unique climatic conditions of the Calgary region. A Master's Degree Project was completed in 1998 by the Faculty of Environmental Design at the University of Calgary. The project documented vegetation performance and the suitability of various plants for use in stormwater wetlands in Calgary. In 1998/99, the Parks Foundation Calgary's River Valleys Committee undertook a project to raise funds to develop an educational park for the purpose of informing the public on stormwater management and the resultant wetland habitat. In addition to general public visitation, scientific research will be conducted by the Faculty of Engineering of the University of Calgary to determine the effectiveness of the system for removing contaminants. The Inglewood Bird Sanctuary will manage school programming. A partnership approach and support from community sponsors were essential to the success of this project.

Yellow Fish Road – Storm Drain Marking Program

Trout Unlimited Canada's Yellow Fish Road Storm Drain Marking Program was developed to raise public awareness of the hazards to human health and river life of dumping toxic household compounds down storm drains. Volunteers from the community paint a yellow symbol of a fish next to storm drains.

City of Calgary Storm Outfall Signage

The City of Calgary has clearly identified all storm sewer outfalls, most of which discharge directly to a river or reservoir. The signs indicate that the structure is a stormwater outfall, and have a structure number and the Sewer Division's 24-hour phone number.

Publication of the Stormwater Management Guidelines for the Province of Alberta, January 1999 by Alberta Environment

As noted earlier, these guidelines are intended to help municipalities, local authorities, consulting engineers and developers in the planning and design of stormwater management systems in Alberta. They outline the objectives of stormwater management and the available methodologies and concepts for the planning, design, and operation of stormwater management drainage systems.

Public Awareness Brochures

The City of Calgary has produced several brochures to increase public awareness about stormwater including *Protect Our Environment: Use the Storm Systems Properly*, *Storm Water Wet Pond*, and *How Can I Protect My Family and Property From Flooding: How the Storm Sewer System Works*.

Parks Foundation, Calgary River Valleys Committee Workshop, October 1998

On October 24, 1998, the Parks Foundation Calgary's River Valleys Committee hosted a day-long forum to discuss potential solutions to issues associated with surface water management in Calgary's river valleys – the need to manage storm and surface run-off water entering the waterways and to mitigate impacts resulting from the placement of facilities such as wet and dry ponds in and adjacent to the river and creek valleys. The forum was attended by 42 individuals representing agencies and volunteer committees most directly affected by the development and approval of surface water management facilities.



RECOMMENDATION

All parties in the basin should take responsibility and action to increase awareness and education about urban stormwater management in the basin.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Identify appropriate public forums and organize and/ or participate in public information sessions on urban stormwater management.
2. Identify opportunities on an ongoing basis, to work with other organizations, such as the Canadian Water Resources Association, to provide information on urban stormwater management and to encourage exchange of information.

TIMEFRAME		
Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	✓

The Bow River Basin Water Council **recommends** that:

1. Alberta Environment determine what information is provided to young people in schools and add information on urban stormwater management as appropriate.
2. Local governments undertake programs to increase awareness and understanding of urban stormwater management.
3. Other members of the Council and other stakeholders in the basin make appropriate efforts to increase awareness and understanding of urban stormwater management.
4. Trout Unlimited continue the Yellow Fish Road Program and that all members of the Council endorse this initiative.
5. The Calgary River Valleys Committee continue with the Elbow Valley Constructed Wetland project and all members of the Council endorse this initiative.

TIMEFRAME		
Short Term	Medium Term	Ongoing
✓	✓	✓
✓	✓	✓
✓	✓	✓
		✓
		✓

3.7 FUNDING NEEDS AND OPPORTUNITIES

ACHIEVEMENTS

Canada-Alberta National Infrastructure Program (NIP)

The National Infrastructure Program has provided funding for a number of projects in the City of Calgary related to stormwater quality management, scientific research and education.



RECOMMENDATION

Local governments in the basin should identify their current and future funding needs to meet urban stormwater management requirements in the basin and identify possible funding opportunities.

ACTIONS

The Bow River Basin Water Council **will undertake to:**

1. Define the scope of urban stormwater management issues in the Bow River Basin, identify changes necessary to address those issues, understand funding needs and identify possible funding opportunities.
2. Investigate potential “economic tools” and implications of land use planning options to improve urban stormwater management, and the feasibility of their use in the Bow River Basin.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	
	✓	

The Bow River Basin Water Council **recommends** that:

1. All parties work to raise local awareness and support for the costs of urban stormwater management.
2. The provincial government and local governments implement appropriate economic tools and appropriate land use planning options to improve urban stormwater management.
3. Local governments, Alberta Environment and the Bow River Basin Water Council should work together to assess whether Municipal Reserve and Environmental Reserve lands should be considered for siting stormwater management facilities and if so, under what guidelines.

TIMEFRAME

Short Term	Medium Term	Ongoing
✓	✓	✓
	✓	✓
✓	✓	

4.0 Summary of Recommendations

Urban Stormwater Management as a Part of a Watershed Planning Approach

- All parties in the basin should endorse integrating urban stormwater management into a watershed planning approach. All parties should clarify their roles and responsibilities, and make a commitment to effectively implement this approach.

A Firm and Clear Regulatory Framework

- Alberta Environment should provide clear direction on the regulatory requirements for urban stormwater management in the basin, in cooperation with local governments. The roles and responsibilities of regulators and of other parties should be clarified.

Using Best Management Practices

- All parties in the basin should support the development, use, monitoring, evaluation and improvement of best management practices, with consideration of local conditions and needs.

Science and Innovation

- All parties in the basin should support research and encourage innovation related to urban stormwater management.

Monitoring

- The needs for monitoring to determine impacts of urban stormwater on surface water and groundwater quality should be defined, within the context of the overall water quality monitoring framework in the basin. Roles and responsibilities for this monitoring should be clarified.
- The needs for performance monitoring of urban stormwater systems should be defined, and roles and responsibilities clarified.

Awareness and Education

- All parties in the basin should take responsibility and action to increase awareness and education about urban stormwater management in the basin.

Funding Needs and Opportunities

- Local governments in the basin should identify their current and future funding needs to meet urban stormwater management requirements in the basin and identify possible funding opportunities.

Appendices



Appendix A

A Proposal for a Watershed Approach for Urban Stormwater Management in the Bow River Basin

A PROPOSAL FOR A WATERSHED APPROACH FOR URBAN STORMWATER MANAGEMENT IN THE BOW RIVER BASIN

NOTE: This material was circulated to workshop participants in advance for discussion purposes.

INTRODUCTION

Stormwater management has become an area of increasing concern in the Bow River basin. Several issues have contributed to this concern. There has been an increasing awareness of the impacts of stormwater discharges on water quality. Upstream jurisdictions need to address impacts on receiving waters and downstream jurisdictions. Stormwater discharges are difficult to regulate as there are both non-point and point sources of stormwater. And, population growth is resulting in increasing demands on the water resources of the basin.

The Bow River Basin Water Council has organized the April 30th workshop, in cooperation with the Canadian Water Resources Association, to encourage discussion and action on improving stormwater management in the basin. The focus of the workshop will be urbanized land areas.

The following proposal for a watershed approach for urban stormwater management is intended to stimulate discussion. The workshop will start with a presentation on the proposal. Participants at the workshop will be asked to provide their comments and advice. There will also be working sessions to discuss how issues can be addressed and to better define the roles and responsibilities of all of the parties in the basin regarding stormwater management.

BACKGROUND

Controlling Stormwater Discharges

In the past, managing stormwater meant controlling and managing the flow of water as land was developed. The main consideration was removing water as efficiently as possible to prevent flooding and drainage problems. Stormwater management became increasingly sophisticated with a growing awareness of impacts on receiving watercourses and water bodies. Methods to retain water were developed to address impacts from high flows resulting from large rainfall and snowmelt events. Methods were also developed to address erosion and other changes in watercourses and water bodies that were caused by frequent smaller releases from normal rainfall and snowmelt events.

Water Quality Concerns

In recent years, the significance of water quality aspects of stormwater has been recognized. “Historically, there has been a tendency to regard stormwater as a relatively minor pollution source – a nuisance rather than a real problem. Numerous studies since about 1970, however, have noted that there is significant pollution from stormwater. Urban runoff can have characteristics similar to raw sewage. It is usually high in suspended solids and organic matter that exert an oxygen demand in the receiving waters. It can contribute significant concentrations of toxic metals, salts, nutrients, oils and grease, bacteria, and other contaminants. Stormwater discharges to receiving waters can thus have

significant impacts on potable water supply, aquatic habitat, recreation, agriculture, and aesthetics.” (*Stormwater Management Guidelines for the Province of Alberta, Jan. 1999, p.5-1*) Results of scientific data collection, monitoring and analysis in the Bow River basin have indicated that stormwater releases have had an impact on water quality in the basin.

An Integrated Approach – A Watershed Approach

The focus of stormwater management has broadened from considering only water quantity to an taking an integrated approach, considering changes in land use, physical and biological characteristics of the environment and water quantity and quality. “It is generally recognized that stormwater must be addressed during the planning, design, and construction of our communities, in a different manner than in the past. To achieve development forms which meet our current needs while preserving and maintaining our natural resources for the future, it will be necessary to plan our actions in ways that recognize such things as water quality and quantity, linkages between surface and groundwater, and dependencies between physical and biological resources.” (*Stormwater Management Guidelines for the Province of Alberta, Jan. 1999, p.1-1*)

Watershed planning provides the tools to take an integrated approach. “Watershed planning has become more prevalent in recent years as a planning approach that compatibly integrates natural systems and land-use change. Watershed planning considers similar environmental issues as traditional subdivision or site planning, but at a scale where ecosystem functions and linkages can be identified and the cumulative impacts of development/ resource management strategies evaluated.” (*Stormwater Management Guidelines for the Province of Alberta, Jan. 1999, p.2-9*)

There is a strong foundation of watershed planning in the Bow River basin. Incorporating stormwater management into a watershed planning approach means taking advantage of that foundation and contributing to it. Stormwater management will become better integrated with all of the other considerations in managing the water resources of the basin.

STRATEGY

Incorporating stormwater management into a watershed planning approach will ensure that all parties in the basin:

- consider the impacts of stormwater discharges on the physical and biological characteristics of the receiving watercourse or water body,
- use appropriate means to address concerns related to water quantity and water quality, the cumulative impacts of stormwater discharges and the assimilative capacity of receiving waters,
- use appropriate means to address interjurisdictional issues, and interjurisdictional planning and decision-making, and
- have clear and reasonable roles and responsibilities.

KEY ELEMENTS

Regulatory Framework

A clear regulatory framework is an important element of incorporating stormwater management into a watershed planning approach. The provincial government has the mandate and responsibility to ensure that the water resources of the province are managed wisely and protected for current and future generations. Stormwater systems and works are regulated under the authority of the *Environmental Protection and Enhancement Act* and the *Water Act*. In the past, regulation has addressed the water quantity aspects of stormwater management. This is being broadened to address water quality aspects

as well. Local governments also have authority to control activities within their jurisdictions under the *Municipal Government Act*. (Additional background information is provided in the next section.)

Alberta Environmental Protection will establish clear requirements with respect to stormwater quality for the City of Calgary, other municipalities, and other contributors of stormwater in the basin, using its authority under the *Environmental Protection and Enhancement Act* and the *Water Act*. These requirements will be incorporated into approvals.

The City of Calgary will meet a specified limit for total loadings of pollutants to the Bow River at the downstream boundary of the City, as specified in its approvals. There will also be a requirement to manage and to minimize all point source discharges to the river, to prevent trouble spots on specific reaches of the river within the City. It will be the City's responsibility to determine what measures will be taken within the City boundaries to meet the total loading requirement.

All local governments in the basin will ensure that necessary by-laws are in place to prevent contamination of stormwater.

Planning and Development Framework

While a regulatory framework is necessary, the emphasis will be on the planning and development framework. This means looking at the natural characteristics of the watershed, considering all of the uses of water and working to ensure that stormwater discharges cause the least impact possible. It means being proactive and preventing problems, rather than looking for solutions after problems have occurred. And it means taking a stewardship role with a long term responsibility for the health of the watershed.

Watershed Planning

The highest level of watershed planning is river basin planning. Alberta Environmental Protection is responsible for the continued development of the Bow River Basin Water Management Plan, in consultation with all parties in the basin. Stormwater quality aspects will be considered within this broader context.

Sub-basin Watershed Planning

Sub-basin watershed planning allows for more detailed analysis and planning for watersheds within a river basin. As this is shared responsibility, Alberta Environmental Protection facilitates sub-basin watershed planning with local governments. Considerations related to stormwater quantity have been addressed in sub-basin watershed planning in the past. This needs to be expanded to include water quality aspects and the impacts of stormwater on the physical and biological characteristics of the environment.

Alberta Environmental Protection will ensure that there is a framework in place for municipalities to accomplish the necessary planning for stormwater management. Alberta Environmental Protection has published *Stormwater Management Guidelines for the Province of Alberta, Jan. 1999*. These guidelines are intended to help municipalities, local authorities, consulting engineers, and developers in the planning and design of stormwater systems in Alberta.

Master Drainage Plans and Site Implementation Plans

Master drainage plans and site implementation plans are established components of the planning and development framework. Master drainage plans are focussed at a community-wide level, detailing all drainage features and infrastructure. Site implementation plans for individual developments must fit within the master drainage plans. They provide in-depth technical information for stormwater systems and works.

These plans have supported effective management of stormwater quantity. Local governments will be required to ensure the focus of the plans is broadened to address both water quantity and water quality and to consider the impacts on the physical and biological characteristics of the environment.

Best Management Practices

Best management practices are the design and engineering tools necessary to implement stormwater management plans. As stormwater management changes and evolves, best management practices change and improve as well. "Stormwater Best Management Practices (BMP's) are methods of managing stormwater drainage for adequate conveyance and flood control that are economically acceptable to the community. BMP's are stormwater management methods that retain as much of the "natural" runoff characteristics and infiltration components of the undeveloped system as possible and reduce or prevent water quality degradation." (*Stormwater Management Guidelines for the Province of Alberta, Jan. 1999, p.6-1*)

Master drainage plans and site implementation plans will continue to establish how stormwater will be managed. Best management practices will be chosen to achieve the stormwater management objectives identified in the plans. The most appropriate best management practices will vary with the area, depending on many factors including the type of development proposed, other development in the area, hydrology, soil conditions, environmental sensitivities, and costs.

Monitoring

Monitoring programs are essential to provide information necessary for planning for stormwater management and to determine the effectiveness of stormwater management.

Water Quality Monitoring

Alberta Environmental Protection is responsible for ensuring long term water quality monitoring of the Bow River and for establishing the framework for water quality monitoring throughout the basin. Most of the water quality monitoring of the river is done directly by the department. In some cases, some responsibility for monitoring at specific sites is required in regulatory approvals. Alberta Environmental Protection and the City of Calgary will be cooperating on programs to monitor compliance with the total loadings limit for the City, when it comes into effect.

Performance Monitoring

Local governments are responsible for monitoring the performance of stormwater systems and works. The responsibilities of land developers are specified in approvals for development.

Roles and Responsibilities

Incorporating stormwater management into a watershed approach can only be successful if all the parties in the basin are clear about their roles and responsibilities. There also must be ways for the parties to cooperate and communicate. The following are proposed roles and responsibilities for the Bow River basin.

Provincial Government – Alberta Environmental Protection

- responsible for legislative and regulatory requirements under the *Environmental Protection and Enhancement Act* and the *Water Act*,
- responsible for working cooperatively with the City of Calgary on the establishment of a total loading limit for pollutants discharged to the Bow River within the City of Calgary,

- responsible for development of the Bow River Basin Water Management Plan,
- responsible for facilitating sub-basin watershed planning with local governments,
- responsible for providing a framework for municipalities to accomplish the necessary planning for stormwater management, and
- responsible for long term water quality monitoring of the Bow River and for establishing a framework for overall water quality monitoring in the basin.

Local Governments

- responsible for compliance with provincial approvals,
- in the case of the City of Calgary, responsible for compliance with provincial approvals, including compliance with total loading limits specified in the City's Wastewater and Storm Drainage Approvals under the *Environmental Protection and Enhancement Act*,
- responsible for undertaking sub-basin watershed planning in cooperation with the provincial government and other local governments,
- responsible for ensuring that there are master drainage plans and site implementation plans for individual developments, based on a watershed planning approach,
- responsible for ensuring that proposed best management practices are acceptable to achieve the requirements in the plans,
- responsible for developing any necessary by-laws to address contamination of stormwater, and
- responsible for performance monitoring of stormwater management systems and works.

Land Developers

- responsible for the development of master drainage plans and site implementation plans based on a watershed planning approach, and
- responsible for proposing the use of best management practices that will meet the requirements of master drainage plans and site implementation plans.

Bow River Basin Water Council

- responsible for providing a forum to support the incorporation of stormwater management into a watershed planning approach,
- responsible for participating in basin wide watershed planning activities, including the Bow River Basin Water Management Plan,
- responsible for providing coordination on sub-basin watershed planning,
- responsible for organizing and encouraging implementation of cooperative stormwater management strategies,
- responsible for supporting public education and improved public awareness regarding stormwater management, and



- responsible for recommending improved stormwater management practices and performance measures to the Minister of Environmental Protection, jurisdictions in the basin, other stakeholders and the public.

Other Stakeholders

- responsible for supporting and participating in cooperative approaches to stormwater management, and
- responsible for supporting public education and increased public awareness regarding stormwater management.



Appendix B Workshop Discussion Materials

QUESTIONS FOR DISCUSSION GROUPS GROUP DISCUSSIONS – SESSION 1

1. REACTION TO THE PROPOSAL FOR A WATERSHED APPROACH

- What is your overall reaction to the *Proposed Watershed Approach for Urban Stormwater Management in the Bow River Basin*?
- What do you like about it? What are your concerns with it?
- What issues do you see arising with such an approach?
- What improvements could you suggest?

2. GENERAL ISSUES/ SUGGESTIONS ABOUT STORMWATER MANAGEMENT

- In general, what are the issues related to stormwater management in the Bow River basin, in your opinion?
- What are your suggestions for improving stormwater management in the Bow River basin?

GROUP DISCUSSIONS – SESSION 2

1. REGULATORY FRAMEWORK

- Is the regulatory framework clear?
- Is the regulatory component strong enough? too strong?
- How should regulatory requirements be enforced?

General Questions:

- *Is the current regulatory environment adequate?*
- *If not, how should it be changed?*

2. PLANNING AND DEVELOPMENT FRAMEWORK

- Is the planning and development framework clear?
- What are the cumulative effects of stormwater discharges, from both a water quantity and water quality perspective, and how can these effects be predicted, monitored and assessed?
- How can issues related to planning and development that affect different communities/ jurisdictions in the basin be addressed?
- How should sequential development in communities and in the basin as a whole be handled?
- What information and/ or research is needed to support improved stormwater management in the basin?

General Questions:

- *How can the planning and development framework support improved stormwater management in the Bow River basin?*
- *The following questions can be the same as the above: What are the cumulative effects of stormwater quantity and quality.....What information and/or research is needed.....?*

3. ROLES AND RESPONSIBILITIES

- Are the roles and responsibilities clear?
- What are your comments about the roles and responsibilities? Would you suggest any changes?

General Question:

- *How can the various parties in the basin, the provincial government, local governments, land developers, the Bow River Basin Water Council and other stakeholders do more to address stormwater management in the basin?*

4. IMPLEMENTATION

- What are the implications of changes to stormwater management in the basin - costs, the time required for approval processes, responsibility for development and infrastructure design, commitments to long term operation and maintenance, commitments to monitoring, other?
- How should/ could the proposed approach be implemented?
- What are reasonable time frames for implementation?
- What would the costs associated with implementation be and how can those costs be addressed?
- What types of monitoring are needed? Who should bear the costs of the monitoring?
- What innovative approaches are being used or should be tried in the basin?
- What cooperative approaches are needed in the basin and how can they be encouraged and used?
- What can the Bow River Basin Council do to support achieving the overall goal of improved stormwater management in the basin?

General Questions:

- *The above questions can be used with a change to question 2:*
- *How should changes to stormwater management in the basin be implemented?*

5. ISSUES

- Issues were identified during the morning session – are there any issues that have not been discussed yet? How can these be addressed?
 - *Is there anything else missing?*



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Resources
Association Association
Canadienne
des Ressources
Hydriques



Workshop Feedback: Session I

Group # _____

In your opinion, what are 3 issues associated with the proposed Watershed Approach for Urban Stormwater Management in the Bow River Basin?

1. _____

2. _____

3. _____

In your opinion, what are 3 strengths of the proposed Watershed Approach for Urban Stormwater Management in the Bow River Basin?

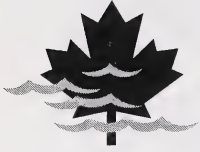
1. _____

2. _____

3. _____

Do you have any other comments about stormwater management in the Bow River Basin?





CWRA ACRH

Canadian
Water
Resources
Association

Association
Canadienne
des Ressources
Hydriques



Workshop Feedback: Session II

Group # _____

In your opinion:

Would you suggest any changes to the proposed regulatory framework?

Is there enough emphasis on using the planning and development framework (or planning and development systems and requirements) to achieve improved stormwater management?

Would you suggest any changes to the proposed roles for the provincial government, local governments, land developers, the Bow River Basin Water Council or other stakeholders?

Are there any other ideas/ innovations you would like to see taken in the Bow River Basin?

What are the most important actions that should be taken in the basin?



Appendix C Profile of the Bow River Basin Water Council

PROFILE OF THE BOW RIVER BASIN WATER COUNCIL

The Bow River Basin Water Council was established in June 1992 by Alberta Environmental Protection to address water quality issues in southern Alberta's Bow River Basin. Through the Council, stakeholders in water use management pool their skills, expertise, perspectives, and resources for the purposes of improving water use management in the Bow River Basin.

The collective vision of the Council is:

Human activity affecting surface and groundwater within the Bow River Basin will be managed so as to protect human health and ecological integrity, and to be environmentally sustainable.

The Council's mandate is:

For the purposes of protecting and improving the waters of the Bow River Basin and with respect to any social, cultural, economic and environmental aspects of:

- *the quality and quantity of groundwater and surface water*
- *riparian zones*
- *the effects of human activity and land use on surface and groundwater quality and quantity*

in the Bow River Basin, the Bow River Basin Water Council will:

- *maintain a forum for all stakeholders to share perspectives*
- *participate in water use management and basin planning*
- *prioritize stakeholder water issues, develop action plans, and organize and encourage implementation of cooperative water use management strategies*
- *monitor, evaluate and report on programs to the Minister, stakeholders and the public*
- *recommend improved water use management procedures and performance measures.*

The Council serves all Albertans, including the general public and stakeholder groups with involvement or interest in water use management. These stakeholders include municipal, provincial and federal governments; First Nations; recreation groups; industrial water licensees; irrigation districts; hydropower producers; health authorities and groups; and environmental groups.

The membership is capped at 40 with up to 10 in each of the following four categories:

1. *elected local government or their representative*
2. *regulatory and administrative bodies*
3. *licensees and commercial water users*
4. *non-commercial water users*

The Council meets four to six times per year.

Appendix D

Bow River Basin Initiatives Contact Information

BOW RIVER BASIN WATER COUNCIL

Any questions regarding this report may be directed to:

The Bow River Basin Water Council
#303, 2938 11 St. N.E.
Calgary, AB T2E 7L7

Telephone: (403) 297-6476
Fax: (403) 297-6069
E-mail: brw.council@gov.ab.ca

GUIDEBOOK TO WATER MANAGEMENT

This guidebook, currently being prepared for the Bow Basin Plan, provides comprehensive information on water management in the basin. It will be available in the near future.

For more information, please contact the Bow River Basin Water Council.



Appendix E

List of Conference Presentations and Speakers

MUNICIPAL STORMWATER MANAGEMENT: ISSUES AND CHALLENGES APRIL 29, 1999

INTRODUCTION

Overview of Stormwater Issues

Menno Homan, Chair, Bow River Basin Water Council

David Trew, Alberta Environment

PANEL DISCUSSION – PERSPECTIVES ON STORMWATER MANAGEMENT

The Perspective of the Provincial Government – Alberta Environment Perspective

Peter Watson, Regional Director, Bow River, Alberta Environment

The Perspective of a Large Urban Community – the City of Calgary

Zennon Zalusky, Sewer Division, Engineering and Environmental Services Dept., City of Calgary

The Perspective of Small Communities and Rural Subdivisions

Frank Misura, Supervisor of Development Services, Planning and Development, Municipal

District of Rocky View

The Perspective of Property Developers

Jim Dewald, President, Hopewell Development Corporation

The Perspective of River Valley Users

Bill Morrison, Calgary River Valleys Committee

SOLUTIONS TO STORMWATER ISSUES

Local Best Management Practices for Municipal Areas

Bert Van Duin, Urban Drainage Specialist, AGRA Earth and Environmental Limited

Jennifer Sharp, Systems Planning Engineer, Sewer Division, Engineering and Environmental Services Department, City of Calgary

Local Projects/ Innovation

Dennis Westhoff, President, Westhoff Engineering Resources Inc.

Yin Deong, Water Quality Engineer, Sewer Division, Engineering and Environmental Services Department, City of Calgary

Innovations from Another Jurisdiction – Information from the Ontario Experience

Ed Watt, Professor, Civil Engineering, Queens University

Research on the Impacts of Stormwater/ Runoff Quantity and Quality

Jiri Marsalek, Canadian Centre for Inland Waters, Environment Canada

Appendix F

List of Workshop Participants

MUNICIPAL STORMWATER MANAGEMENT: SOLUTIONS FOR MUNICIPALITIES IN THE BOW RIVER BASIN APRIL 30, 1999

Al Cowan	Lee Maher Engineering Associates Ltd.
Al Sosiak	Alberta Environment
Al Taylor	Calgary Area Outdoor Council
Alanna Dean	City of Calgary
Alex Iskander	Infrastructure Systems Ltd.
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